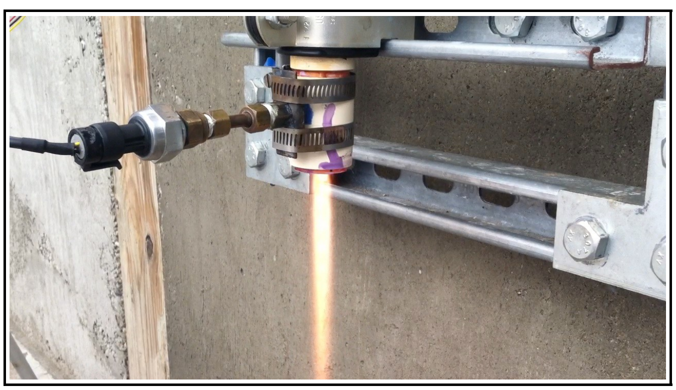
Executive Summary

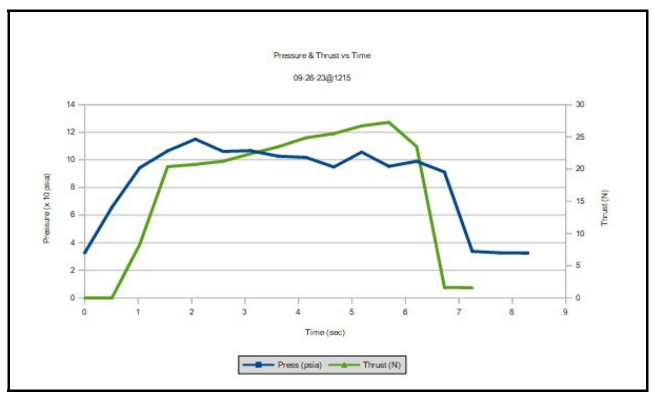
This month, I ran some test to study the ignition time of the $PLA/KMnO_4$ fuel core after weeks of storage in a dry bag. There were three test, the first was stored in dry bag for ~ 6 months, the second for 24 days, and the third for 31 days. All other parameters were the same. Ignition times varied from 0.4 sec to 0.6 sec. The shorter the ignition time the longer the burn time for a given amount of propellant. The total propellant mass was ~ 115 gm, just under the FAA regulation for a class I rocket. As such, the procedure is to store $PLA/KMnO_4$ hybrid fuel cores in a dry bag for a minimum of two weeks and as long as four weeks.

Once again, the endoscope shows a nice even burn of the fuel core. The injector evenly distributes the spray around the fuel core. The cone angle of the spray is clearly visible and there is an even burn distribution.

Technical Stuff

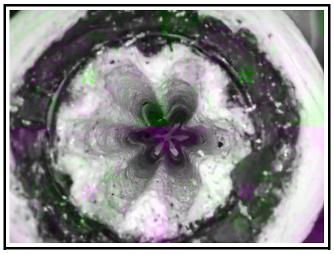
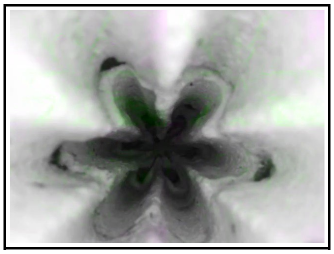
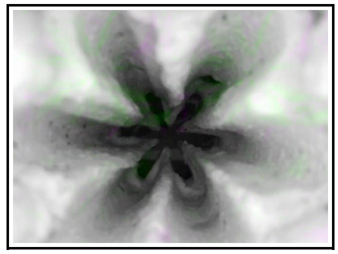
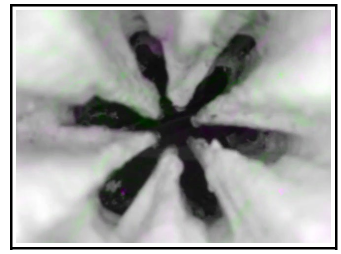
This month, I tested for the ignition time of the $PLA/KMnO_4$ fuel core after weeks of storage in a dry bag. There were three test, the first was stored in dry bag for ~ 6 months, the second for 24 days, and the third for 31 days. The first test, after six months of storage, was reported in the Aug EOM report. The first test led to the examination of long term fuel core storage. The second and third test were from three weeks and four weeks respectively. All other parameters were the same. The oxidizer fuel load was 62.5 ml of ~ 90% HTP and 2.5 ml of ethanol (O/F = 25). Ignition times varied from 0.4 sec to 0.6 sec. The shorter the ignition time the longer the burn time for a given amount of propellant. The total propellant mass was ~ 115 gm, just under the FAA regulation for a class I rocket. As such, the procedure is to store $PLA/KMnO_4$ hybrid fuel cores in a dry bag for two to four weeks.





The graph shows a typical test run for all three test. The peak pressure was ~ 115 psia and average was ~ 102 psia. The graph shows a starting thrust of ~ 20 N with peak thrust was ~ 27 N and an average thrust of ~ 24 N.

Once again, the endoscope shows a nice even burn of the fuel core. The first picture below shows the even burn. The $PLA/KMnO_4$ does not reach the wall of the 1" CPVC pipe indicating longer burn times are possible. The edzieba variable orifice flow restrictor is completely melted away. In the second picture the dark spots show the joint of the two 6 cm fuel core segments. The third and four picture show the injector evenly distributes the spray around the fuel core. The cone angle of the spray is clearly visible and there is an even burn distribution.

Next month, I want to run some test without the check valve. I added a check valve after the solenoid valve several years ago because the pressure spikes in the combustion chamber destroyed the solenoid valve. Now that I have a better understanding of the combustion process, I think I can risk it. Not only do I save ~ 25 gm of mass, there is an ~ 5 psi pressure drop across the check valve. As such, there will be an increase in the initial mass flow rate resulting in a higher ignition surface flux. What effect will this have on ignition? I'll find out. Also, the higher pressure in the combustion chamber may reduce the oxidizer mass flow rate but could still result in a higher thrust, if it doesn't blow up first. Stay tuned!